

KENWOOD
HI/FI STEREO COMPONENTS

SERVICE MANUAL

KA-400

An item of adjustment is written in three languages — English, French and German.

Un article sur réglages est écrit en trois langues, Anglais, Français et Allemand.

Ein Artikel der Abgleich wird auf drei Sprachen, Englische, Französisch und Deutsch geschrieben.



DC STEREO INTEGRATED AMPLIFIER

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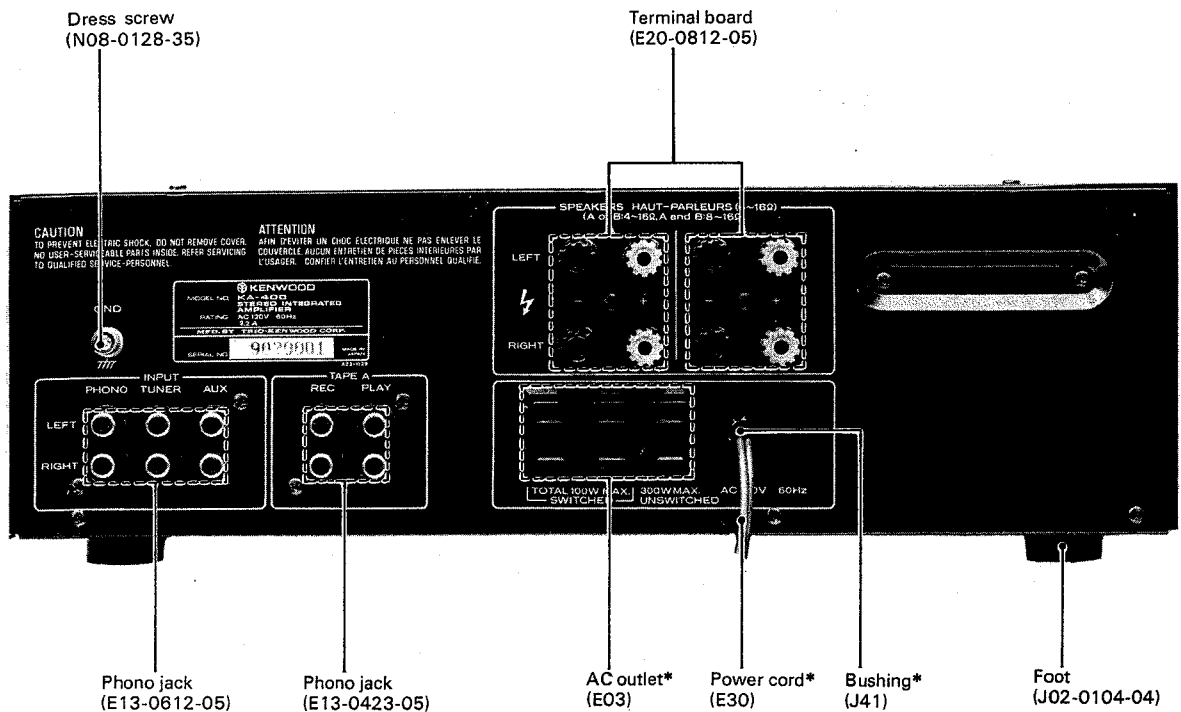
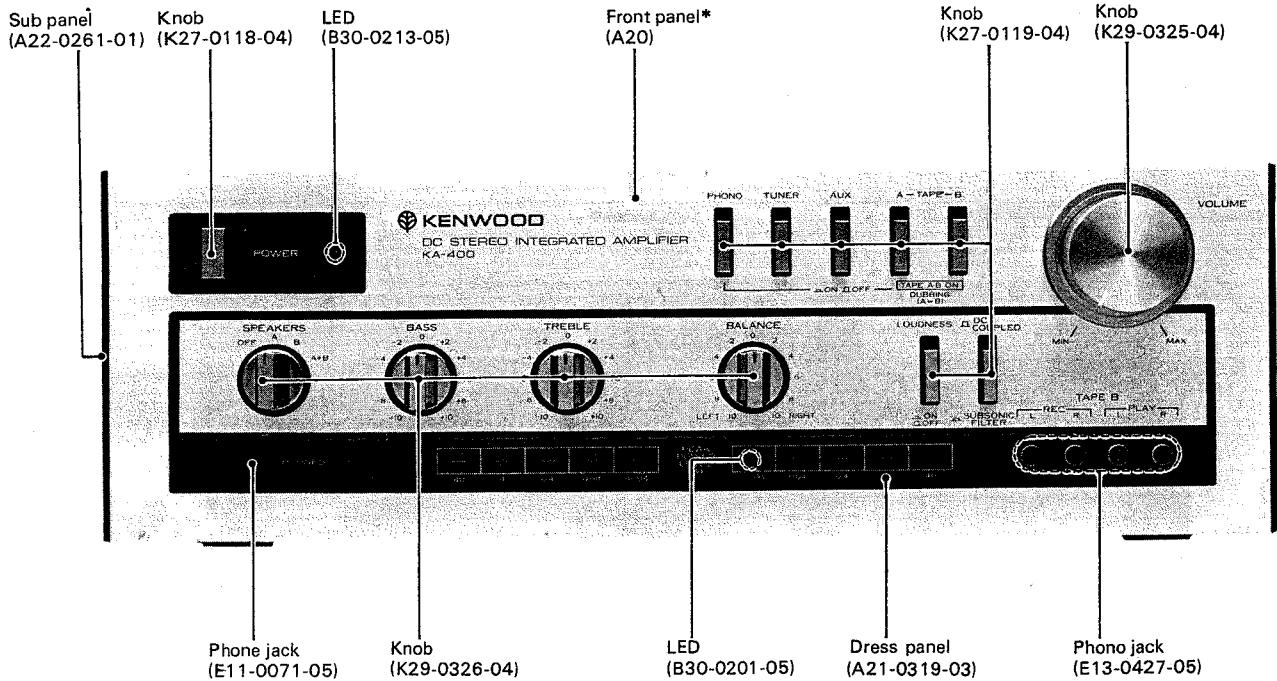
Note:

Component and circuitry are subject to modification to insure best operation under differing local conditions. This manual is based on the U.S.(K) standard, and provides information on regional circuit modification through use of alternate schematic diagrams, and information on regional component variations through use of parts list.

Region	Code
U.S.A.	K
Canada	P
PX	U
Australia	X
Europe and Scandinavia	E
England	T
South Africa	S
Other Areas	M

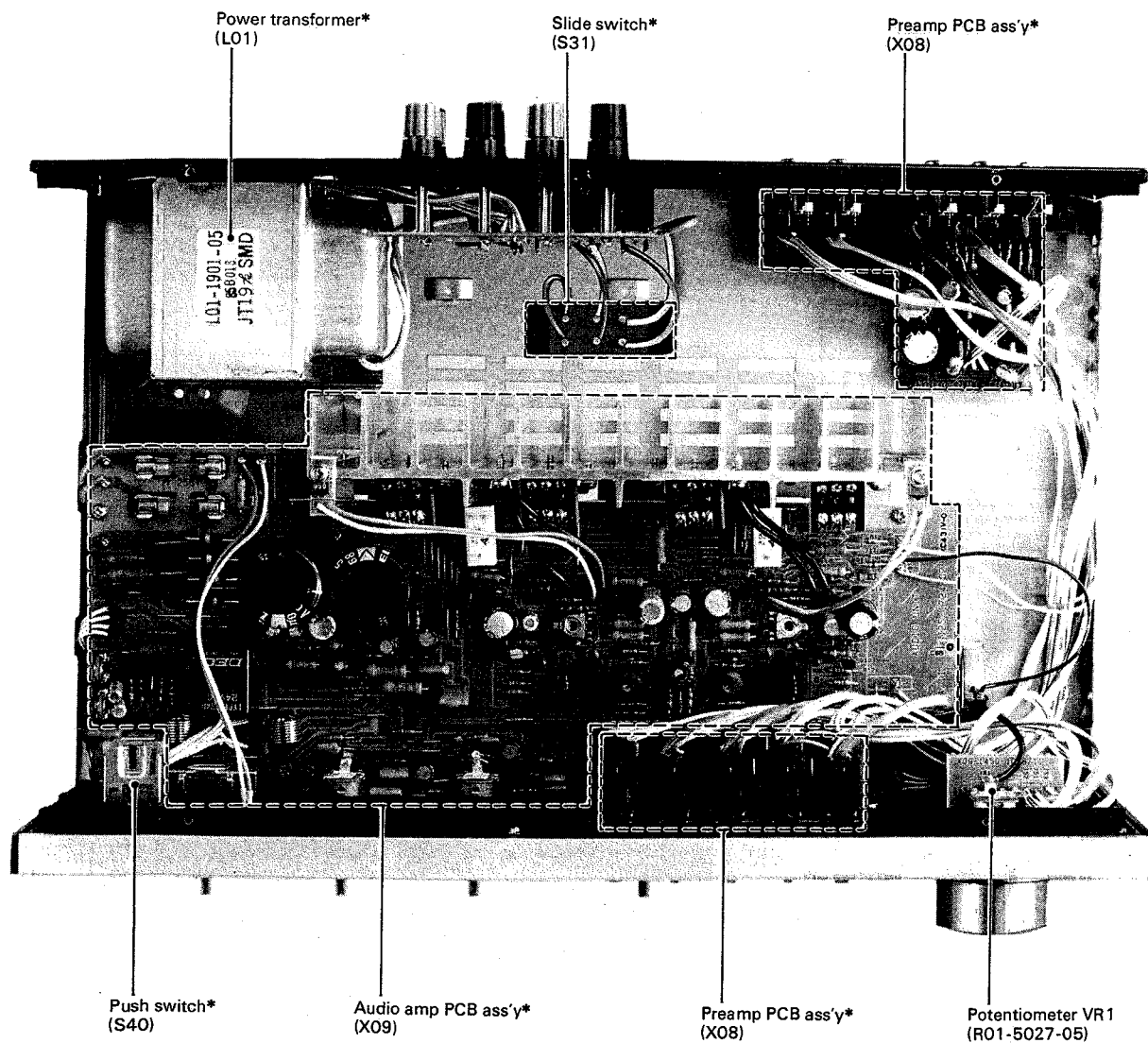
There is no plan for producing units of S types.

EXTERNAL VIEW



* Refer to parts list.

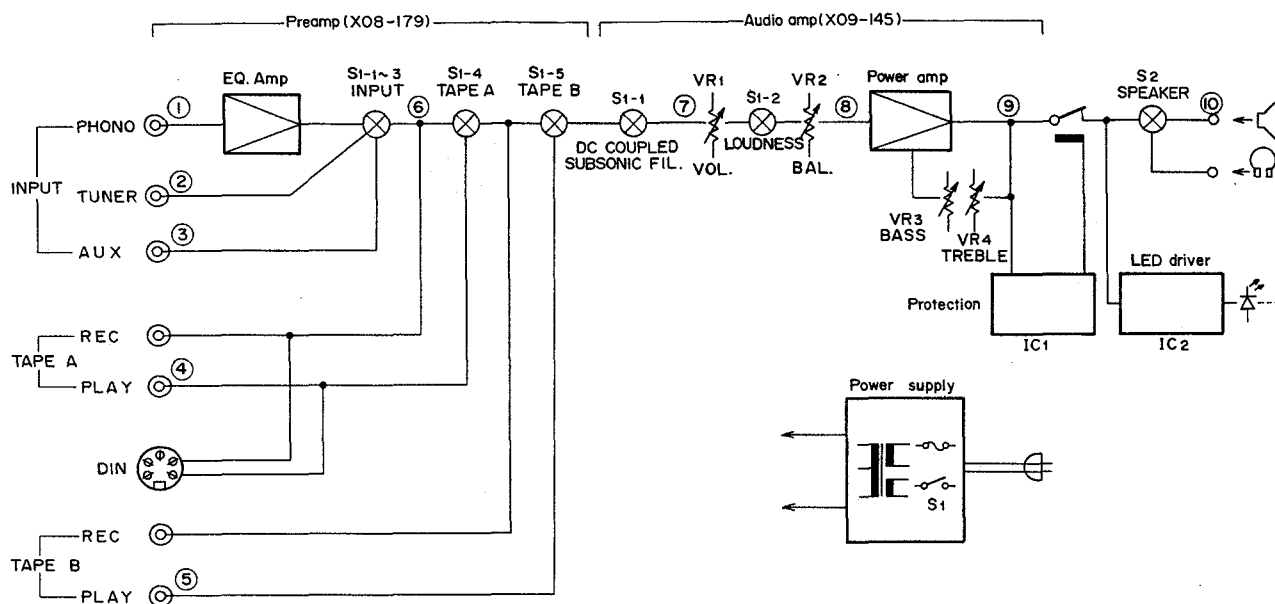
INTERNAL VIEW



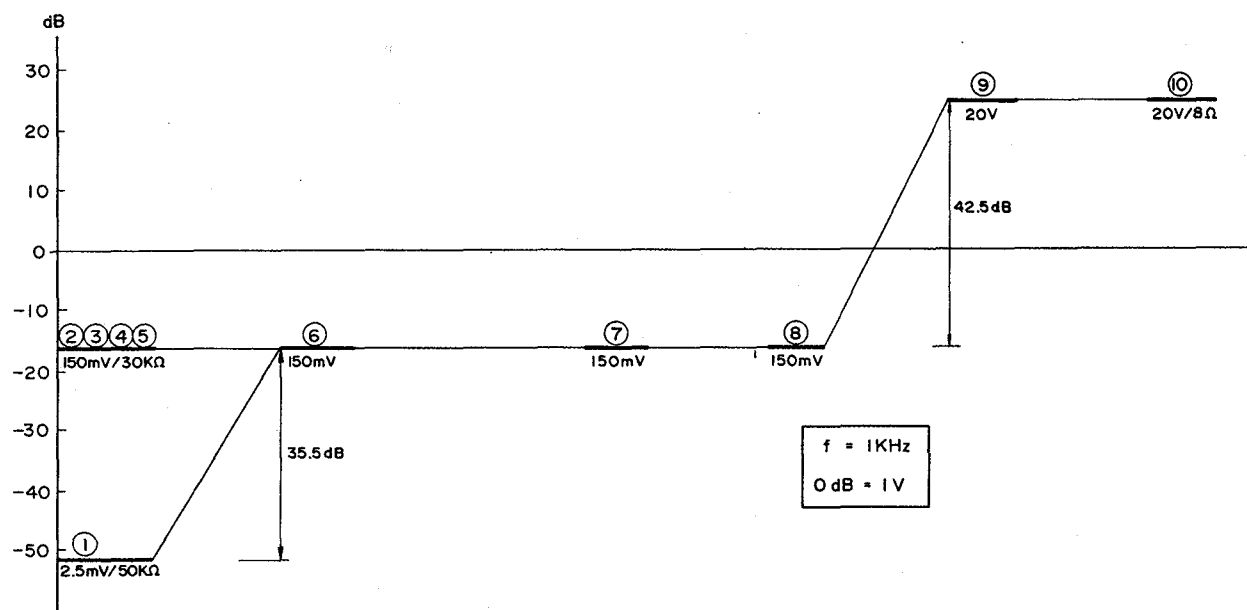
* Refer to parts list.

BLOCK AND LEVEL DIAGRAM

BLOCK DIAGRAM



LEVEL DIAGRAM



CIRCUIT DESCRIPTION

NON-SWITCHING CIRCUIT

Generally, power amplifiers are designed to operate in class B so that a high efficiency can be obtained. However, transistor amplifiers operated other than in class A cause the switching distortion and crossover distortion.

The crossover distortion is caused when a small signal is amplified in the nonlinear input/output characteristics range of a class B push-pull amplifier.

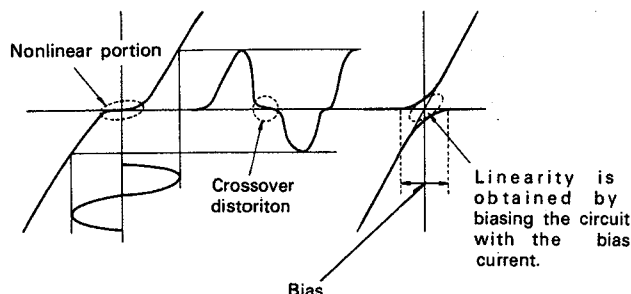


Fig. 1 Crossover distortion

The signal distortion due to the nonlinear amplification is called the crossover distortion, and it can be eliminated by biasing the circuit with the bias current so as the amplifier operates like that of class AB.

The switching distortion is caused by the delay of the switching operation of a transistor pair used in a class B push-pull amplifier.

The output stage of a power amplifier is, generally, connected in SEPP mode.

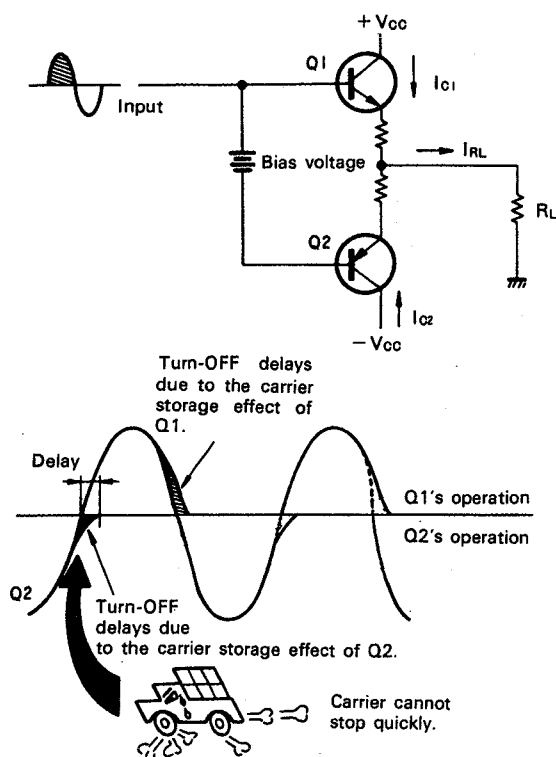


Fig. 2 Switching distortion

In figure 2, when an alternating signal is applied to the input, Q1 turns ON and Q2 is cut OFF in the positive half cycle; conversely, Q1 is cut OFF and Q2 turns ON in the negative half cycle. However, switching of conduction from Q1 to Q2, and vice versa, is not smooth because of the carrier storage effect.

Assuming that the input signal makes a transition from negative to positive, the Q1 turns ON immediately according to the input signal. However, the Q2 is not cut off immediately due to the carrier storage effect. The Q1 is already conducting a large current when the Q2 is completely cut off. This situation is also identical for a transition from positive to negative.

A non-switching amplifier reduces the distortion due to the carrier storage effect by conducting a current even through the OFF side transistor.

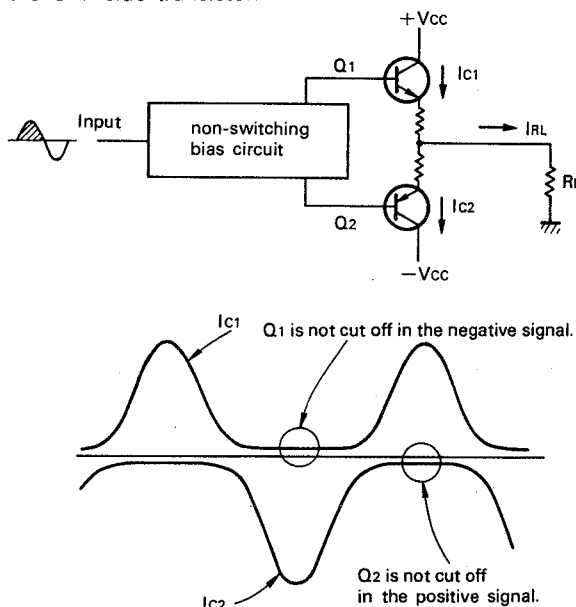


Fig. 3 Non-switching amplifier

The following figure shows the basic circuit diagram of KA-400 power amplifier.

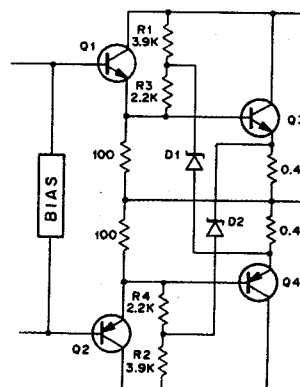


Fig. 4 Basic circuit diagram of KA-400, power amplifier

CIRCUIT DESCRIPTION

Transistors Q1 and Q2 are the drivers, and Q3 and Q4 are power transistors. Zener diodes D1 and D2, having the zener voltage of 14V, make up the non-switching bias circuit together with resistors R1 through R4. Assuming a conventional class B power amplifier, when a positive signal is input, Q1 and Q3 turn ON and Q2 and Q4 are cut off. However, in the present circuit, Q4 is not cut off since it is biased through R2, R4 and D2. Similarly, when a negative signal is input, Q3 is not cut off since it is biased through R1, R3 and D1. This operation is further explained by the following figure.

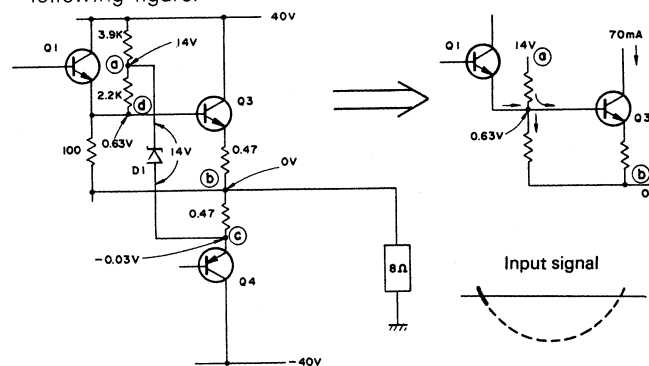


Fig. 5 Input signal goes from positive to negative

At the time when the input signal voltage goes from positive to negative ① (**Fig. 8**), the driver transistor Q1 is conducting a collector current and the zener diode D1 is also in active to produce 14V at point ②. A part of the Q1's emitter current and a current from point a through the resistor are supplied to the base of the power transistor Q3 as a bias current. Then Q3's collector current will be approximately 70 mA.

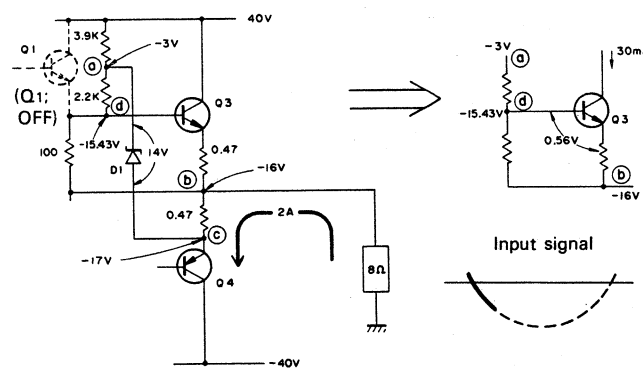


Fig. 6 Input signal is negative

The above figure shows the states of the circuit when the input signal is negative ② (**Fig. 8**) and the Q4's collector current is 2A. Since ② ampere flows through the 8-ohm resistor, the voltage at point ⑤ becomes -16V . Most of this current flows through the emitter resistor of Q4, making -17V at point ③. The voltage at point ① is higher than that of point ③ by 14V which is the zener voltage of D1, thus resulting in the point ① voltage at -3V . At this time, Q1 is cut off, and the voltage at point ④ is -15.43V which is the difference of voltages at points ① and ⑤ divided by resistors of $2.2\text{ k}\Omega$ and 100Ω .

Now, let's examine the operation of transistor Q3 referring to

the voltages at points **a** through **d** . The base-emitter voltage V_{BE} of Q3 is 0.56V (see **Fig. 5, 6** and **7**), thus the Q3 is not cut off. The Q3's collector current will be about 30 mA, which is reduced from the initial 70 mA.

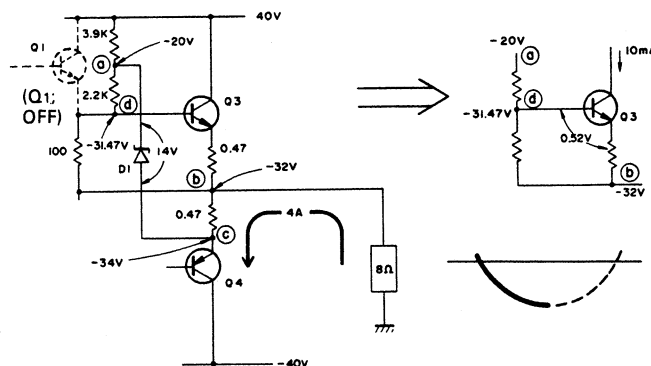


Fig. 7 Input signal is more negative

When the signal voltage becomes larger in negative ③ (**Fig. 8**), the voltage drop across the Q4's emitter resistor increases, resulting in a reduction of Q3's V_{BE} . Thus the collector current further decreases to become about 10 mA, but the Q3 will never be cut off. The following figure shows the voltage of various points in the circuit relative to the time.

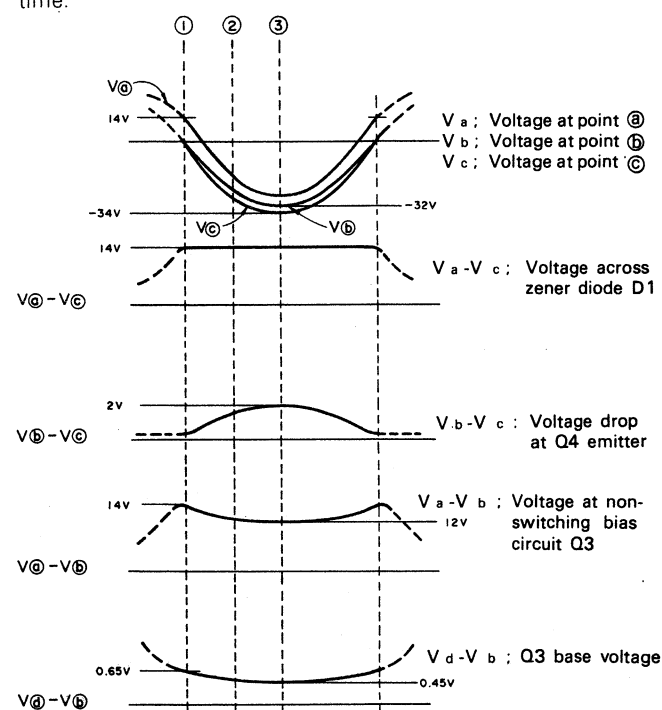


Fig. 8

The behavior of power transistor Q4 with a positive output signal is identical with the operation of Q3 for a negative output, as explained above. Thus, power transistors Q3 and Q4 are not cut off in any case, and the switching distortion by carrier storage effect is reduced. In the actual circuit, a thermistor is connected between the bases of Q1 and Q2, in order to prevent the over-driving of Q3 and Q4 when the ambient temperature rises.

DISASSEMBLY FOR REPAIR

AUDIO AMP PC BOARD ASS'Y

1. Detach the bottom plate **(B)** from **(A)** using a cutter.

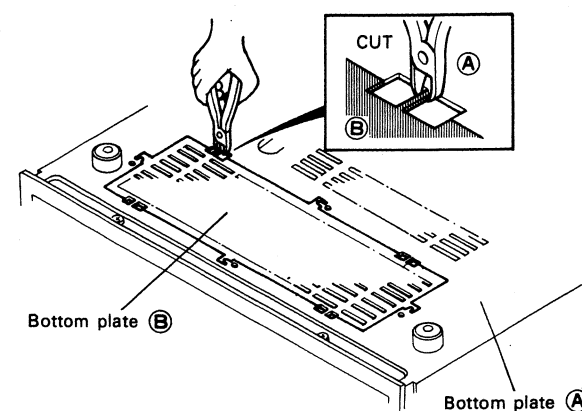


Fig. 1

- 2.** Turn the bottom plate **(B)** 180° as shown.

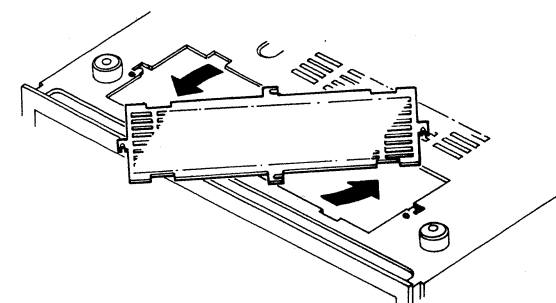


Fig. 2

- 3.** Attach the bottom plate **(B)** with screw as shown.

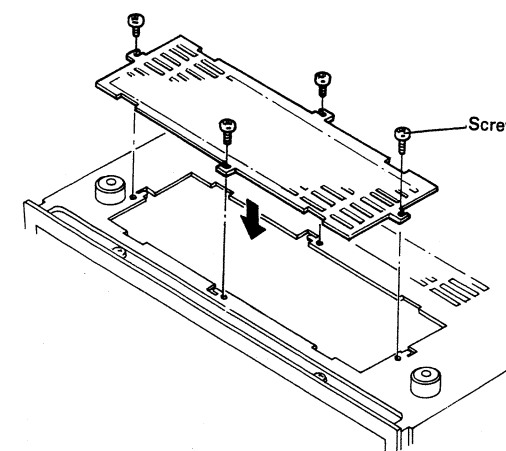


Fig. 3

POWER TRANSISTOR

1. Unsolder twelve pins from connection P.C. board.

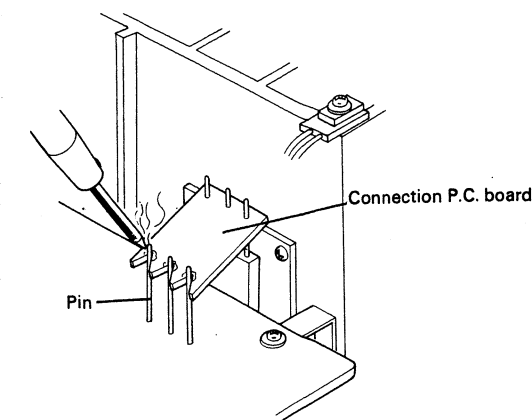


Fig. 4

2. Remove four screws (A) on the heat sink.
Remove four screws (B) fixing the heat sink.

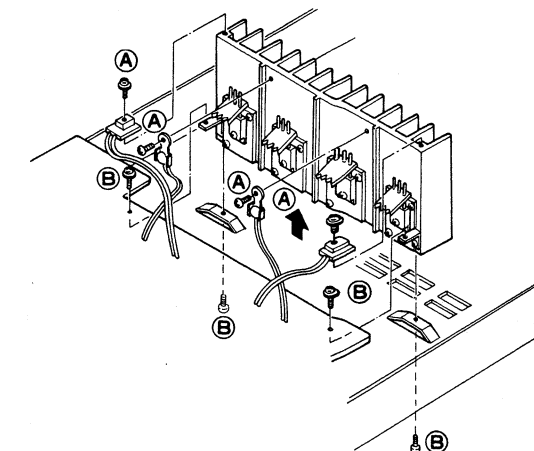


Fig. 5

3. Remove the defective transistor from heat sink ②.
4. Paint thermal compound on the heat sink ② where a new transistor is to be mounted.
5. Mount a new transistor on the heat sink ②

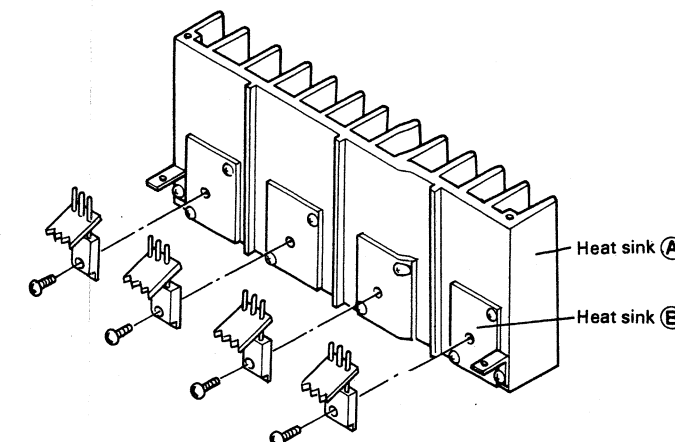


Fig. 6

ADJUSTMENT/RÉGLAGES/ABGLEICH

1. POWER AMP OFFSET VOLTAGE ADJUSTMENT

- 1. Connect the DC voltmeter between the positive and negative speaker terminals.
- 2. Adjust the trimming pot VR7 (VR8) for a 0V reading of the DC voltmeter.

1. RÉGLAGE DE LA TENSION DE DECALAGE (OFFSET)

- 1. Brancher le voltmètre de c.c. aux bornes de sortie + et -
- 2. Régler le potentiomètre ajustable VR7 (VR8) pour que la tension de sortie soit nulle.

1. OFFSET-SPANNUNG DER ENDVERSTÄRKER

- 1. Den Gleichspannungsmesser zwischen den Lautsprecherklemmen + und - der endverstärker anschließen.
- 2. Die Regelstange durch das Unterplattenloch einführen und den halbeingebetteten Widerstand VR7 (VR8) so regulieren, daß die Gleichspannungsmesser-Ablesung 0V ist.

2. BIAS CURRENT ADJUSTMENT

- 1. Turn the volume control knob fully counterclockwise.
- 2. Connect the DC voltmeter between the adjusting points ① and ③ (② and ④) of audio amp pc board ass'y (X09-145).
- 3. Adjust the BIAS CURRENT trimming pot VR5 (VR6), for a 70 mV reading of the voltmeter.

2. RÉGLAGE DU COURANT DE POLARISATION

- 1. Tourner le bouton de commande de volume à fond dans le sens invers de celui des aiguilles d'une montre.
- 2. Brancher le voltmètre de c.c. aux points d'alignement, ① et ③ (② et ④), sur la plaque circuit imprimé d'ampli de puissance (X09-145).
- 3. Réguler le potentiomètre ajustable VR5 (VR6) de façon à ce que le voltmètre de c.c. indique 70 mV.

2. LEERLAUFS

- 1. Den Lautstärkereger (VOLUME) drehen um die Leistungsverstärker-Aufnahme auf Null zu reduzieren.
- 2. Den Gleichspannungsmesser zwischen der Regulierungs-Punkte ① und ③ (② und ④) der endverstärker anschließen.
- 3. Den halbeingebetteten Widerstand VR5 (VR6) der Leistungsverstärker so regulieren, daß die GleichspannungsmesserAblesung 70 mV ist.

3. PEAK POWER LEVEL INDICATOR ADJUSTMENT

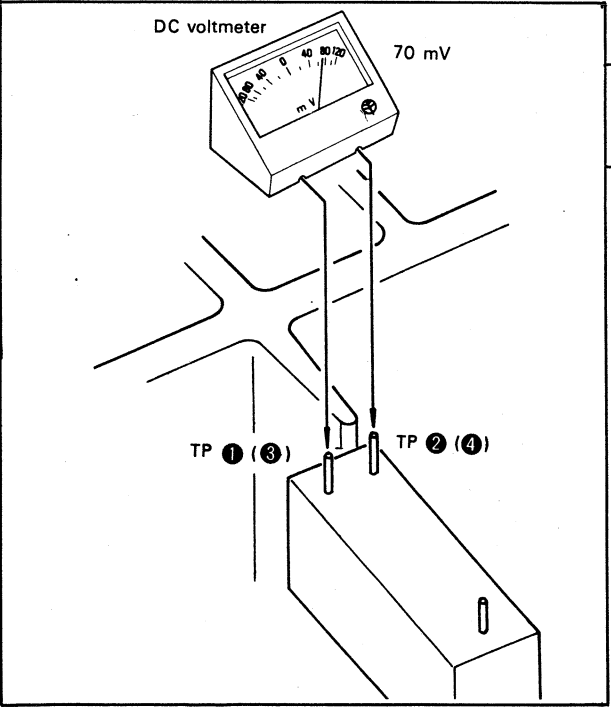
- 1. Connect an AG and dummy load to Aux jack and speaker terminal respectively.
- 2. Connect an AC voltmeter across the dummy load.
- 3. Set the AG to 1 kHz and its output for a 5.6V reading of the AC voltmeter.
- 4. Adjust the trimming pot. VR9 (VR10) so that the 4 LEDs (for 0.004, 0.04, 0.4 and 4) light.

3. REGLAGE DU "PEAK POWER LEVEL"

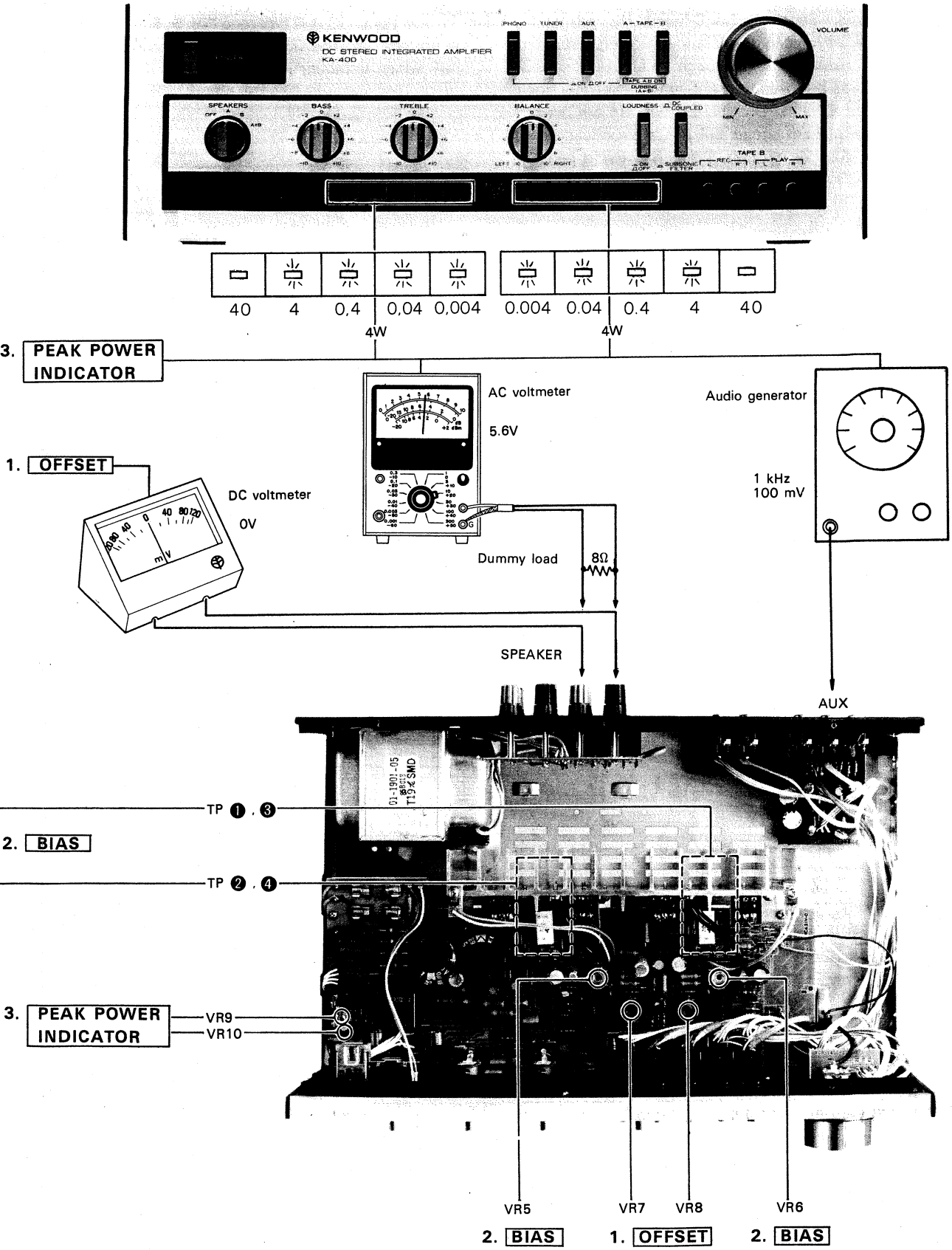
- 1. Relier un AG (générateur de signaux audio) sur les prises Aux et une fausse charge (Resistance) sur les bornes de haut-parleur.
- 2. Relier un voltmètre aux deux extrémités de la resistance (ou aux borne de sortie + et -).
- 3. Journer le potentiomètre d'AG et d'ampli en sortie que un voltmètre indique 5,6V.
- 4. Régler le potentiomètre ajustable VR9 (VR10) en sortie que les 4LEDs (0,004, 0,04, 0,4 et 4W) allument.

3. PEGELEINSTELLUNG DES "PEAK POWER LEVEL" INDIKATOR

- 1. Einen AG (NF-Signalgenerator) an die AUX-Buchsen und eine kunstliche Last (8Ω 100W oder mehr) an die Lautsprecher-Anschlüsse anschließen.
- 2. Einen Wechselstrom-Voltmeter über die künstliche Last anschliessen.
- 3. Den AG auf 1 kHz einstellen. Die Lautstärke regler (oder den AG-Ausgang) so einstellen, daß Votmeter 5,6V anzeigt.
- 4. Das Trimme-Potentiometer VR9 (VR10) so einstellen, daß die 4 LEDs (für 0,004, 0,04, 0,4 und 4) leuchten auf.

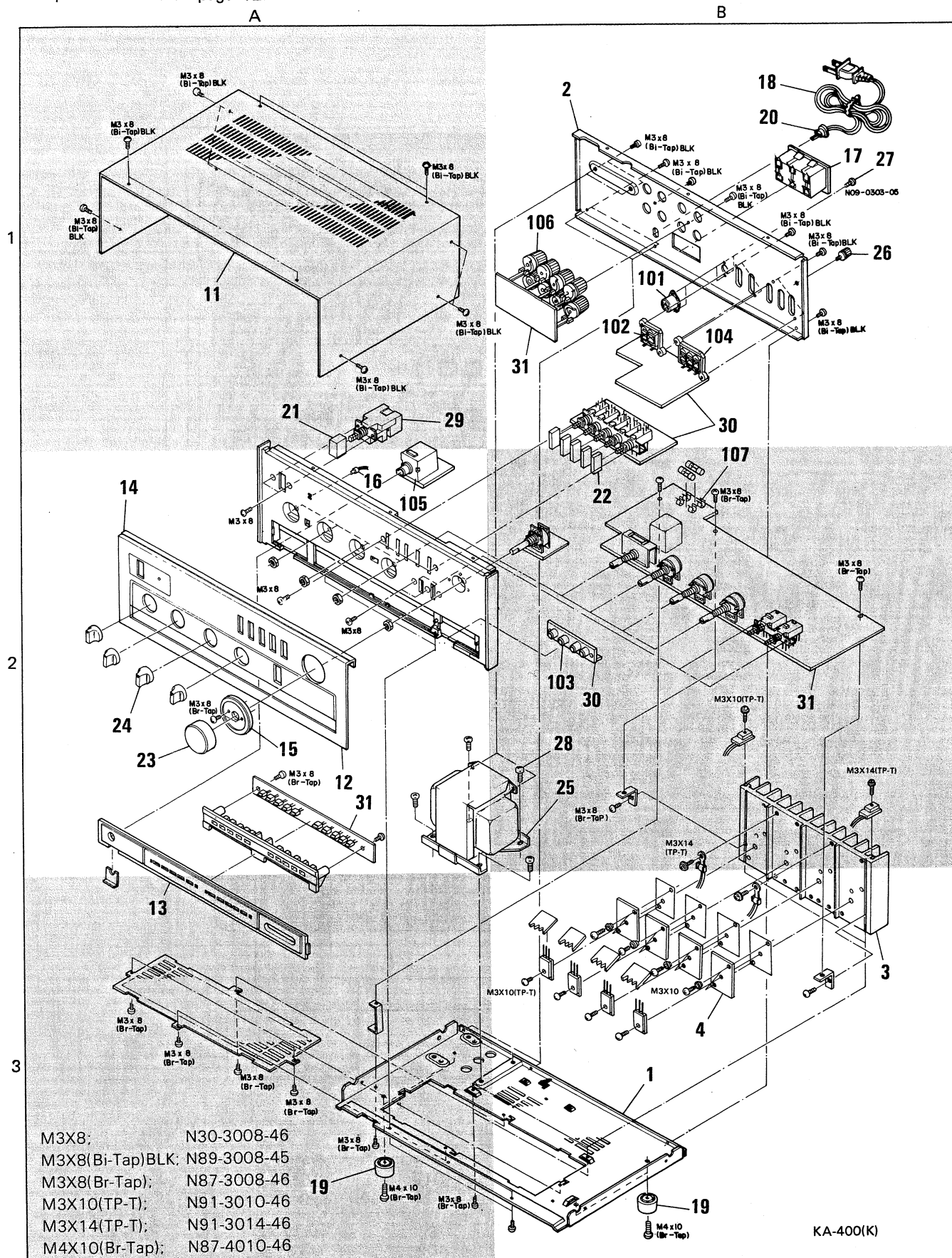


ADJUSTMENT/RÉGLAGES/ABGLEICH



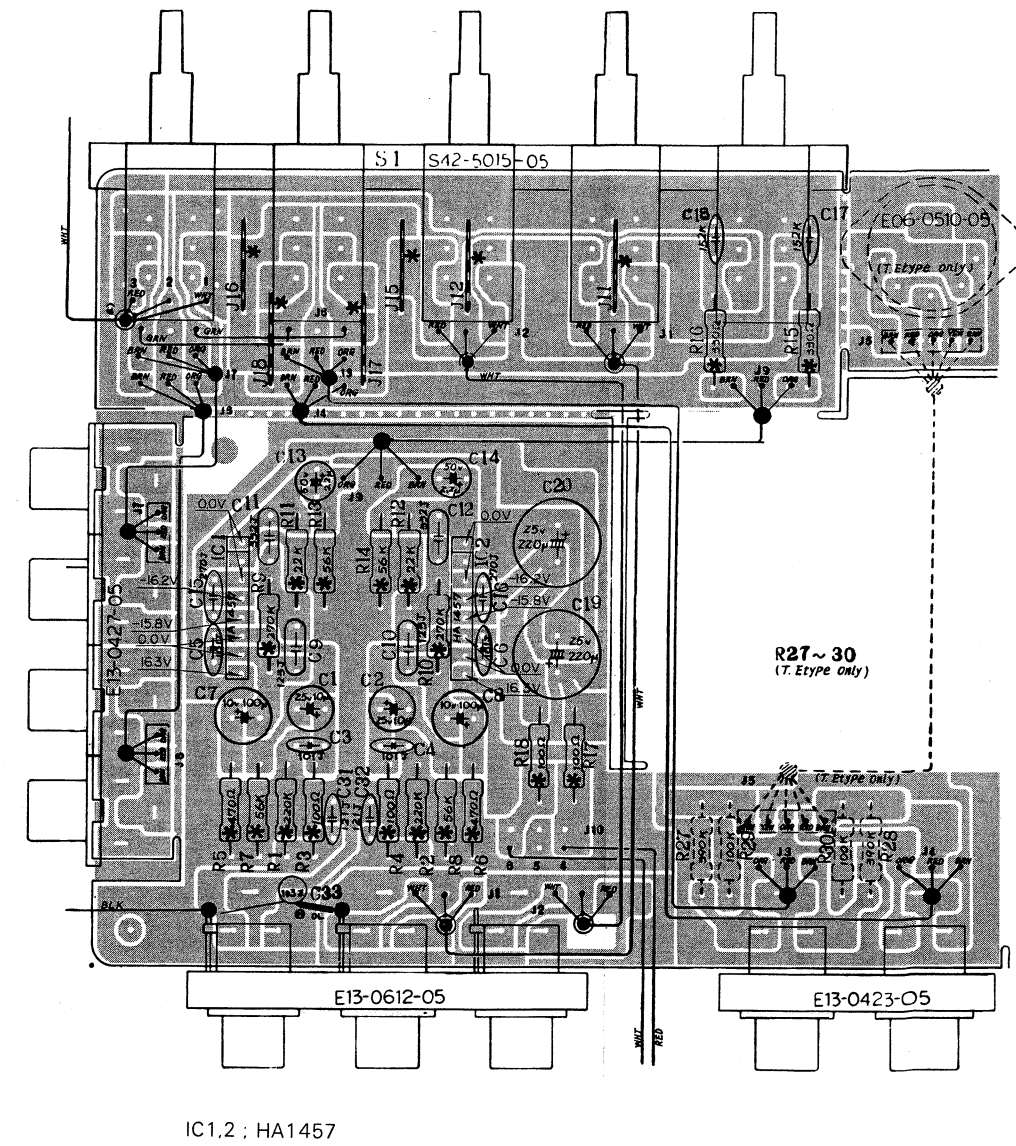
EXPLODED VIEW

See parts numbers on page 12.

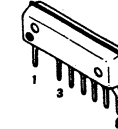


PC BOARD (1)

PREAMP PCB ASS'Y (X08-1790-80, 2-71)
(Component side)

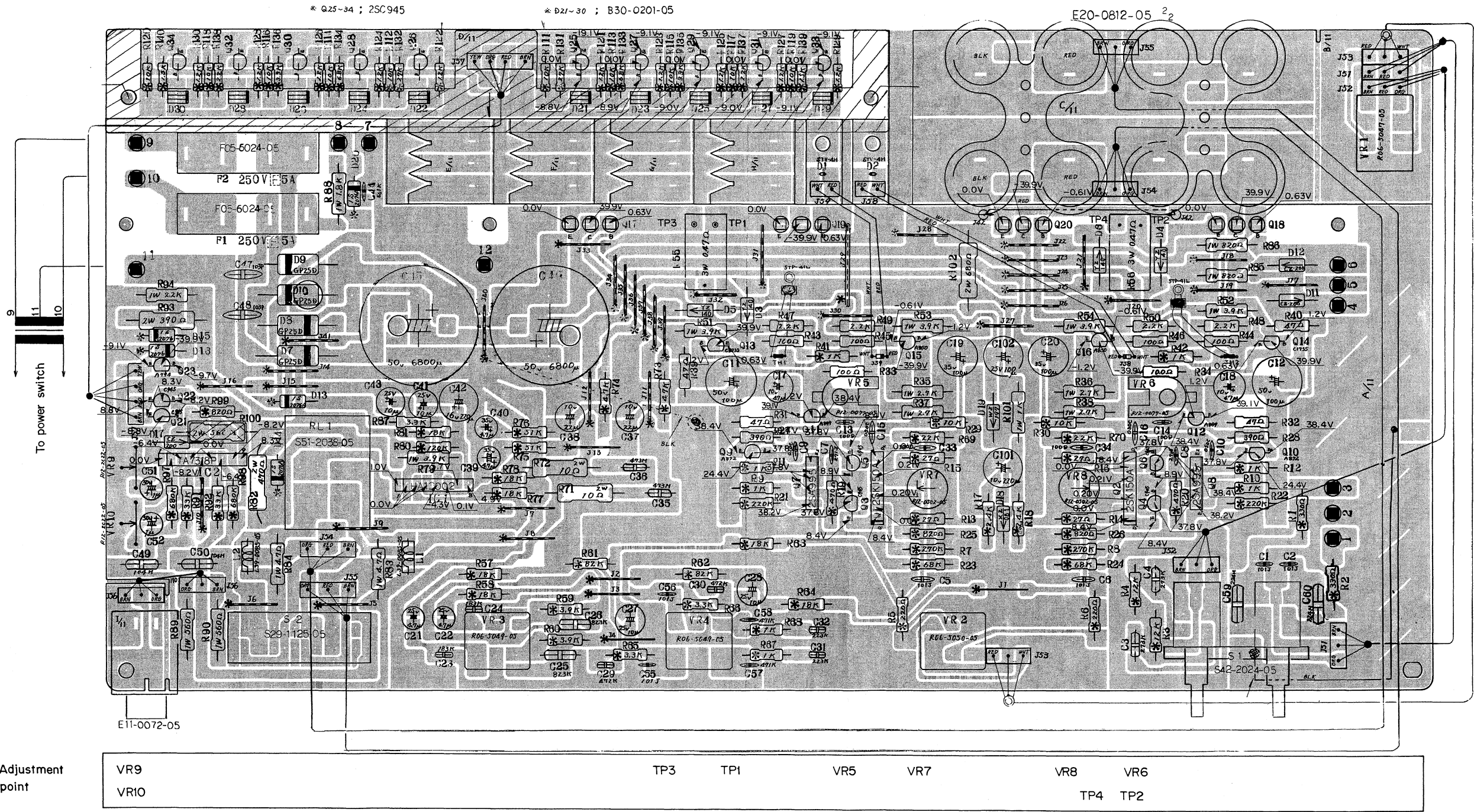


HA1457



PC BOARD (2)

AUDIO AMP PCB ASS'Y (X09-1450-10, 0-81, 2-71)
(Component side)



2SA872
2SC945

2SA850
2SC1735

2SA995

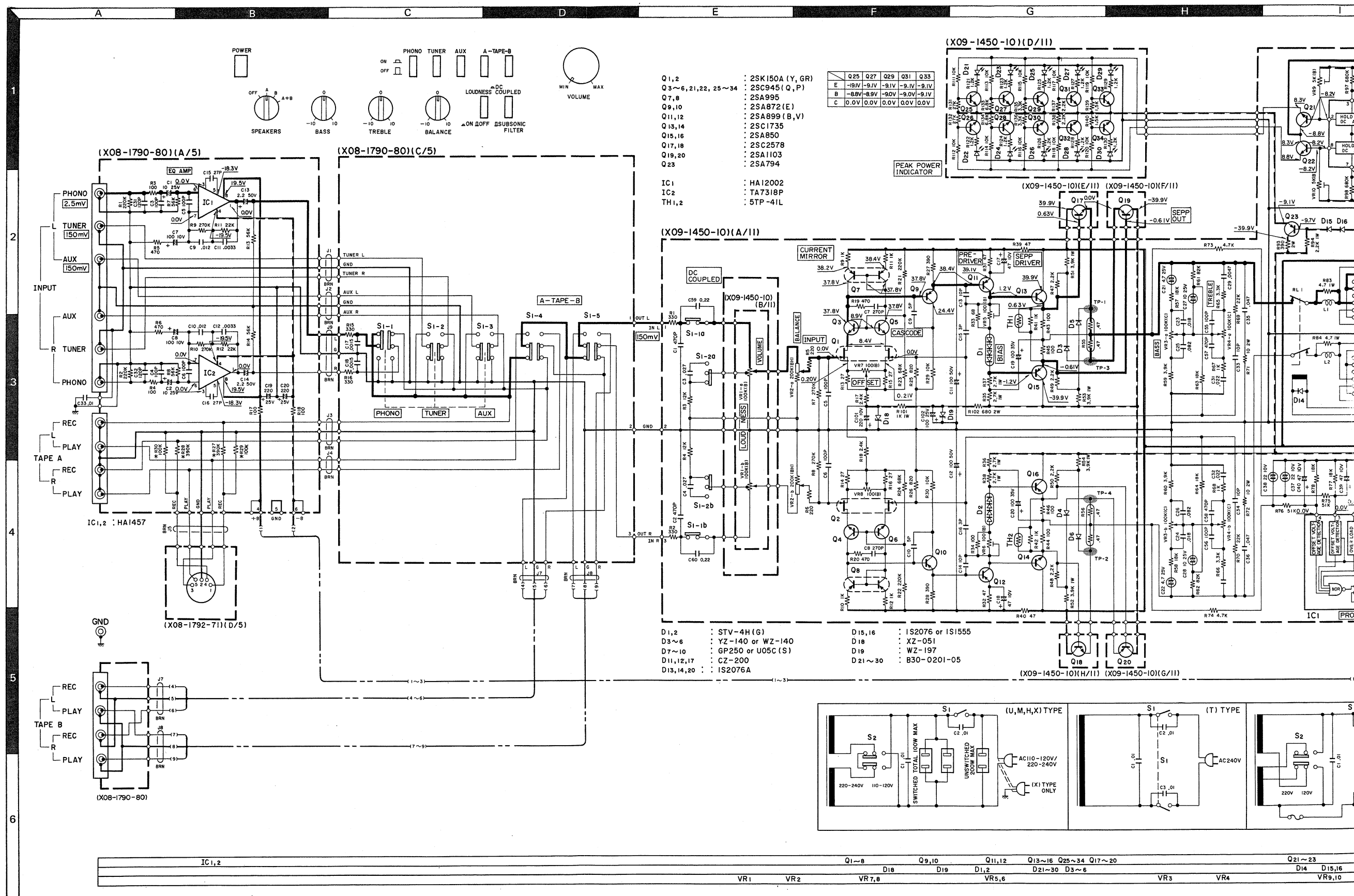
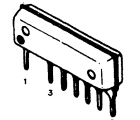
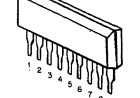
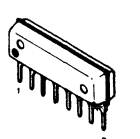
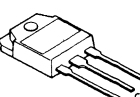
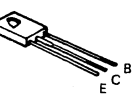
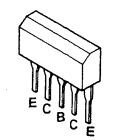
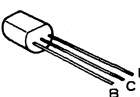
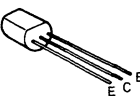
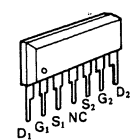
2SA794
2SA899

2SA1103
2SC2578

HA12002

TA7318P

HA1457



PARTS LIST

INSTR

Ref. No. 参照番号	Parts No. 部 品 番 号	Description 部 品 名 / 規 格	Re- mark 備考
D7 -10	V11-0465-05	GP25D	
D11 ,12	V11-4104-70	CZ-200	
D13 ,14	V11-0273-05	1S2076A	
D15 ,16	V11-0271-05	1S2076	
D17	V11-4104-70	CZ-200	
D18	V11-4103-60	XZ-051	
D19	V11-4100-30	WZ-197	
D20	V11-0273-05	1S2076A	
IC1	V30-0291-10	HA12002	
IC2	V30-0292-10	TA7318P	
Q1 ,2	V09-0137-40	2SK150A(Y,GR)	
Q3 -6	V03-0348-05	2SC945(Q,P)	
Q7 ,8	V01-0995-00	2SA995	
Q9 ,10	V01-0189-05	2SA872(E)	
Q11 ,12	V01-0199-05	2SA899(B,V)	
Q13 ,14	V03-0452-05	2SC1735	
Q15 ,16	V01-0173-05	2SA850	
Q17 ,18	V03-2578-00	2SC2578	
Q19 ,20	V01-1103-00	2SA1103	
Q21 ,22	V03-0348-05	2SC945(Q,P)	
Q23	V01-0794-00	2SA794	
Q25 -34	V03-0348-05	2SC945(Q,P)	
TH1 ,2	V22-0027-05	5TP-41L	

Ref. No.
参照番

② → 18 1A
① → 19 2A
19 2A
19 2A
19 2A

⑤ → R221
R222
VR1 , 2
VR3 , 4
VR5 , 6

- ① Exploded view
- ② Position in drawing
- ③ Symbol of part
- ④ Area to which parts No. 1 and 2 (USA). When this is the same part
- ⑤ Reference number
- ⑥ Abbreviation of capacitors and resistors
- ⑦ Abbreviation of capacitors and resistors

- * Abbreviations:
ELECTRO
LL-ELEC.....
NP-ELEC.....
MICA
POLYSTY
MYLAR
CERAMIC
TANTAL
MF
OIL
The unit "U"

- | | |
|---------------------|---------------|
| * Abbreviation | |
| RC | Resistor |
| RD | Diode |
| FL-PROOF | Flameproof |
| RW | Resistor |
| FL-PROOF | Flameproof |
| RN | Resistor |
| FUSE-RESISTOR | Fuse-resistor |
| 2B | 2B |
| 2E | 2E |
| 2H | 2H |
| 3A | 3A |
| 3D | 3D |
| 3F | 3F |
| 3G | 3G |
| 3H | 3H |
| All resistor | All resistor |

- * Abbreviations
- C
D
F
G
J
K
M
Z
P
- ⑧ Resistors R
list. For va

See EXPLODED VIEW on page 9.

INSTRUCTION FOR PARTS LIST

Ref. No. 参照番号	Parts No. 部 品 番 号	Description 部 品 名 / 規 格	Re- marks 備考
D7 -10	V11-0465-05	GP25D	
D11 ,12	V11-4104-70	CZ-200	
D13 ,14	V11-0273-05	1S2076A	
D15 ,16	V11-0271-05	1S2076	
D17	V11-4104-70	CZ-200	
D18	V11-4103-60	XZ-051	
D19	V11-4100-30	WZ-197	
D20	V11-0273-05	1S2076A	
IC1	V30-0291-10	HA12002	
IC2	V30-0292-10	TA7318p	
Q1 ,2	V09-0137-40	2SK150A(Y,GR)	
Q3 -6	V03-0348-05	2SC945(Q,P)	
Q7 ,8	V01-0995-00	2SA995	
Q9 ,10	V01-0189-05	2SA872(E)	
Q11 ,12	V01-0199-05	2SA899(B,V)	
Q13 ,14	V03-0452-05	2SC1735	
Q15 ,16	V01-0173-05	2SA850	
Q17 ,18	V03-2578-00	2SC2578	
Q19 ,20	V01-1103-00	2SA1103	
Q21 ,22	V03-0348-05	2SC945(Q,P)	
Q23	V01-0794-00	2SA794	
Q25 -34	V03-0348-05	2SC945(Q,P)	
TH1 ,2	V22-0027-05	5TP-41L	

- ① Exploded view drawing No.
- ② Position in exploded view.
- ③ Symbol of new parts.
- ④ Area to which parts are shipped. Example: A20-1979-11 is the parts No. of FRONT PANEL ASS'Y for the "K" type products (for USA).
When this column is blank, it means that the same type of parts (same parts No.) are used for the products shipped to all areas.
- ⑤ Reference No. in schematic diagram.
- ⑥ Abbreviation of "Flame proof metal oxide film resistor". All capacitors and resistors are listed using abbreviations.
- ⑦ Abbreviations

- Abbreviations of capacitors (Parts No. with initial letter "C").
- | | |
|---------------|---------------------------------|
| ELECTRO | Electrolytic capacitor |
| LL-ELEC | Low leak electrolytic capacitor |
| NP-ELEC | Non-pole electrolytic capacitor |
| MICA | Mica capacitor |
| POLYSTY | Polystyrene capacitor |
| MYLAR | Mylar capacitor |
| CERAMIC | Ceramic capacitor |
| TANTAL | Tantalum capacitor |
| MF | Metallized film capacitor |
| OIL | Oil capacitor |
- The unit "UF" is used in lieu of " μ F".
- Abbreviations of resistors (Parts No. with initial letters "R").
- | | |
|-------------------|---------------------------------------|
| RC | Carbon composition resistor |
| RD | Carbon film resistor |
| FL-PROOF RD | Flame-proof carbon film resistor |
| RW | Wire wound power resistor |
| FL-PROOF RS | Flame-proof metal oxide film resistor |
| RN | Metal film resistor |
| FUSE-RESIST | Resistor with fuse function |
| 2B | Rated wattage 1/8W |
| 2E | Rated wattage 1/4W |
| 2H | Rated wattage 1/2W |
| 3A | Rated wattage 1W |
| 3D | Rated wattage 2W |
| 3F | Rated wattage 3W |
| 3G | Rated wattage 4W |
| 3H | Rated wattage 5W |
- All resistor values are indicated with the unit (Ω) omitted.

- * Abbreviations common to capacitors and resistors.
 - C $\pm 0.25\text{pF}$ (Used for capacitors only)
 - D $\pm 0.5\text{pF}$ (Used for capacitors only)
 - F $\pm 1\%$
 - G $\pm 2\%$
 - J $\pm 5\%$
 - K $\pm 10\%$
 - M $\pm 20\%$
 - Z $+ 80\%, - 20\%$ (Used for capacitors only)
 - P $+ 100\%, - 0\%$ (Used for capacitors only)
- ⑧ Resistors RD (carbon composition resistors) are not listed in the parts list. For values, refer to the schematic diagram.

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